



**Armed Forces College of
Medicine
AFCM**



Male Genital System

(Interstitial cells and genital ducts)

**Prof. Dr. Manal Hassan
Moussa**

INTENDED LEARNING OBJECTIVES (ILO)



By the end of this lecture the student will be able to:

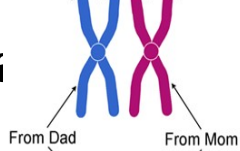
- 1- Describe the microscopic structure (LM & EM) of Leydig cells.**
- 2- Correlate the microscopic structure of Leydig cells to their function.**
- 3- Describe the microscopic structure of intratesticular and extratesticular (epididymis, vas deferens) duct system**
- 4- Correlate the microscopic structure of the epididymis and vas deferens to their function.**
- 5- Interpret the microscopic changes in epididymis and vas deferens in different diseases**

Lecture Plan



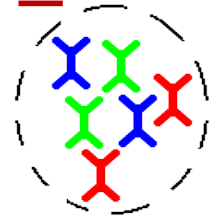
1. Part 1 (5 min)
2. Part 2 (35 min)
3. Part 3 (5 min)
4. Lecture Quiz (5 min)

46 chromosomes in the form of 23 pairs

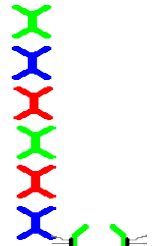


Mitosis

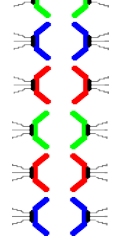
Prophase



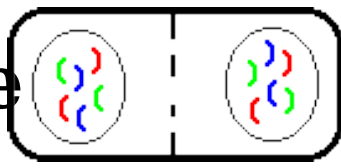
Metaphase



Anaphase

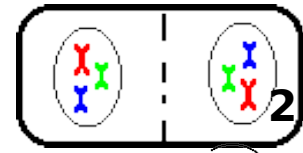
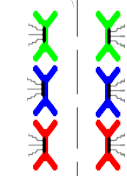
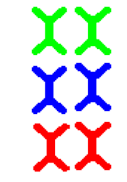
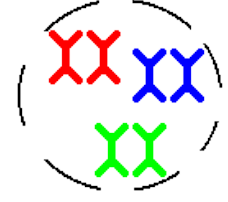
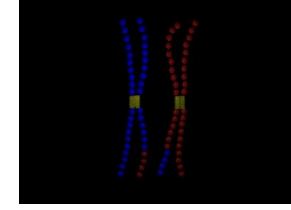


Telophase

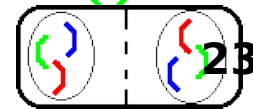
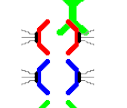
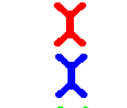


46 s-chromosome

Meiosis



23 d-chromosomes



23 s-chromosomes

Mi**T**osis: each daughter cell ends up with **Two** complete sets of chromosomes.

Sperm production



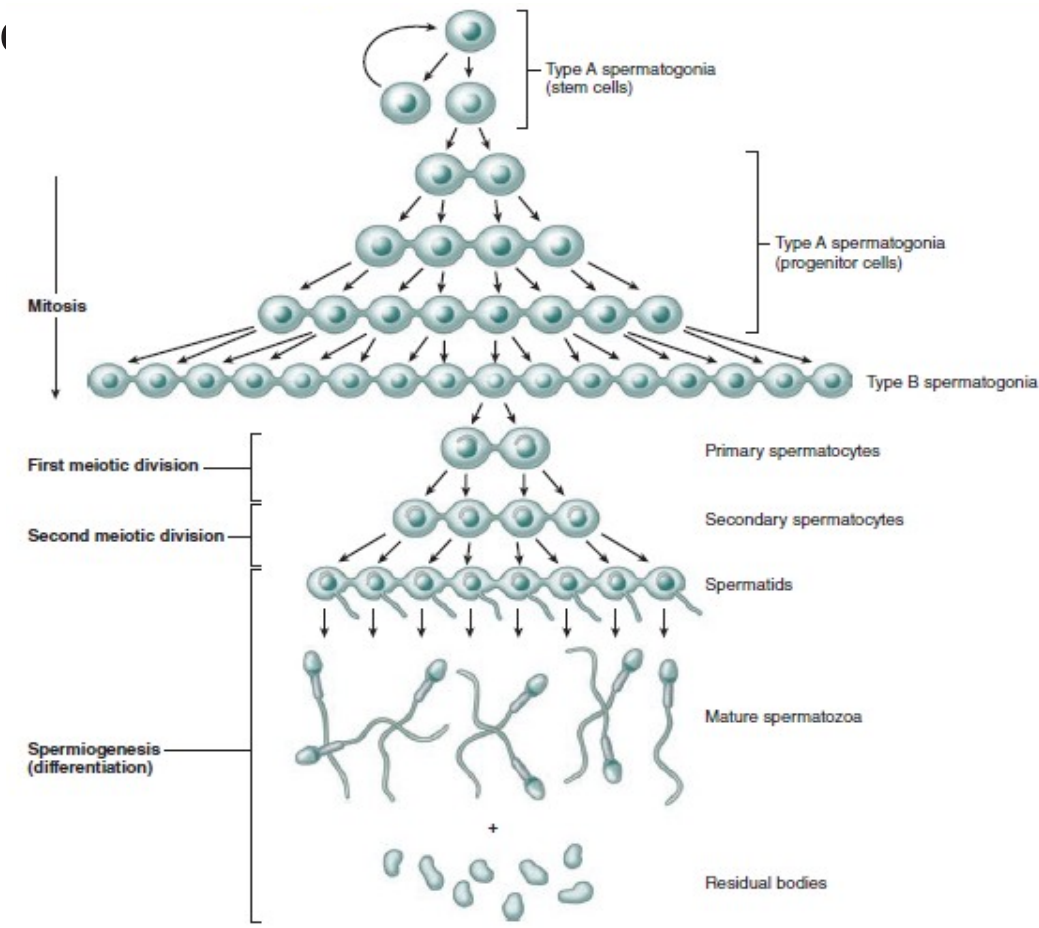
Sperm production (spermatogenesis) includes:

1- **Spermatocytogenesis** including mitosis of spermatogonia and meiosis (1ry&2ry meiotic divisions)----- formation of spermatids from spermatogonia

2- **Spermiogenesis**: spermatids differentiate into

Spermatogenesis

- begins at puberty
- under control of FSH
- lasts about 2 months



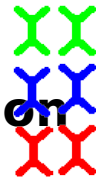
Meiosis



Meiosis includes 2 successive cell divisions: 1st & 2nd
meiotic division

Primary spermatocytes
(46 d-chromosomes)

first meiotic division



Secondary spermatocytes

23 d-chromosomes

Secondary spermatocytes

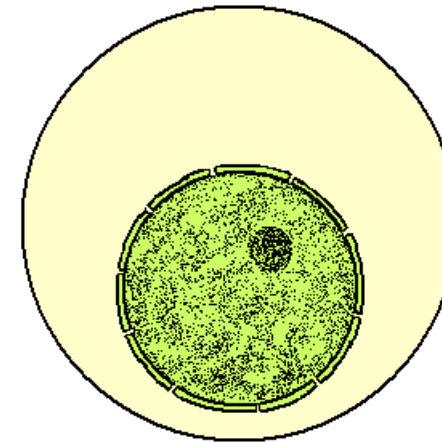
23 d-chromosomes

Second meiotic division



Spermatid Spermatid Spermatid Spermatid

23 s-chromosomes 23 s-chromosomes 23 s-chromosomes 23 s-chromosomes



Meiosis



S phase---each chromosome is of 2 sister chromatids--46d-
chromosomes

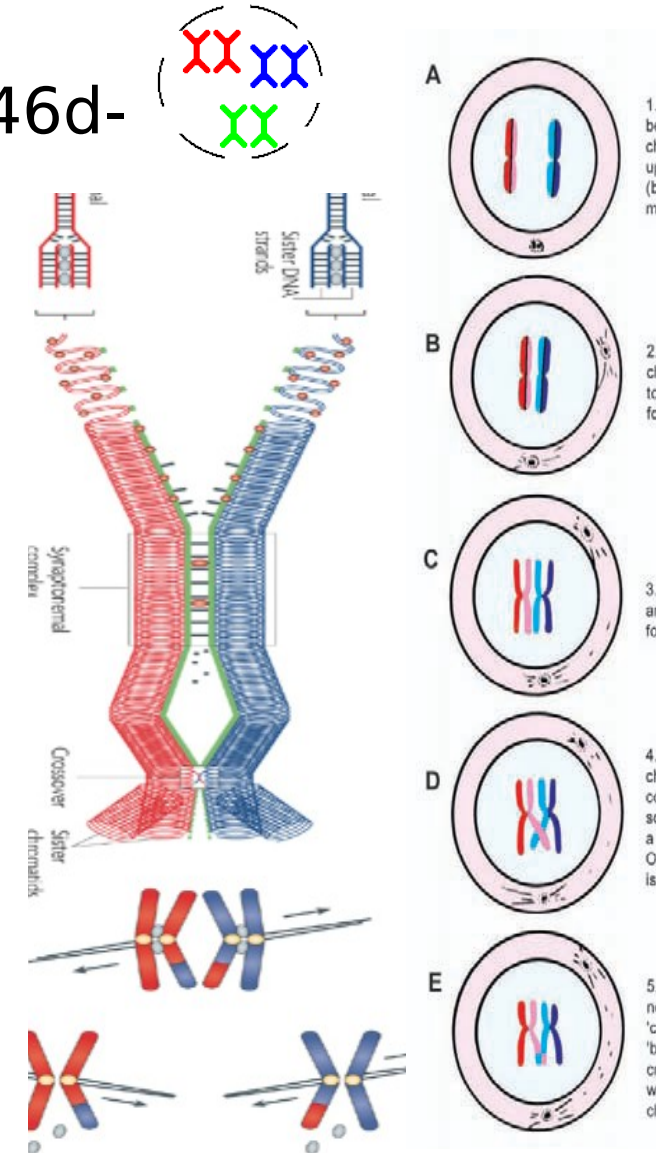


First meiotic division:

Prophase I is **prolonged** (22 days).
chromosomes become **thicker & shorter**.

The 2 chromosomes of each pair (23 pairs) come together & form **synapsis** with formation of **synaptonemal complexes** between the 2 chromosomes where DNA---DNA exchanges between the maternal and paternal chromosomes

Crossing over occurs between the 2 chromosomes at sites called chiasmata (transposition of DNA strands).
Nucleolus and nuclear membrane disappear, mitotic spindle is formed.



Meiosis



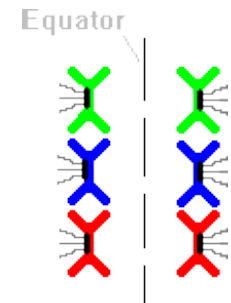
Metaphase I:

The 46 d-chromosomes become attached to the spindle at the equator **in pairs**.



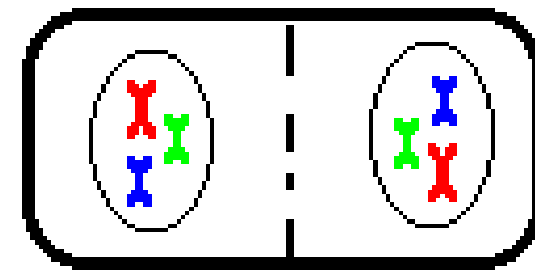
Anaphase I:

- No splitting of the chromosomes
- One entire chromosome of each pair move to each pole of the spindle



Telophase I

- cleavage occurs
- the resulting daughter cells have **23 d-**chromosomes (each chromosome is formed of 2 chromatids).



Meiosis



Second meiotic division

not preceded by S phase. It is similar to mitosis .

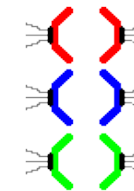
In **metaphase II**, the chromosomes lie up the equator, the kinetochore attach to the spindle.

In **anaphase II**, the 2 chromatids of each chromosome split at the centromere followed by migration of chromatids to opposite poles

Telophase II results in 2 cells; each containing 23s chromosomes

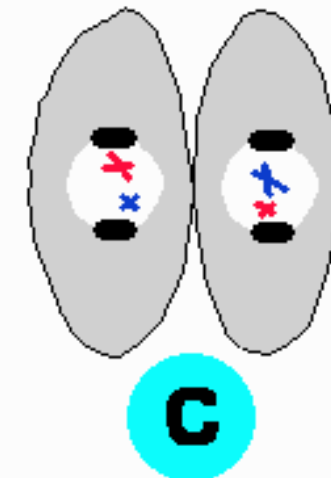
Result of meiosis is 4 daughter cells, each contains 23 s-chromosomes.

Each cells contains either 22X or 22Y chromosomes.

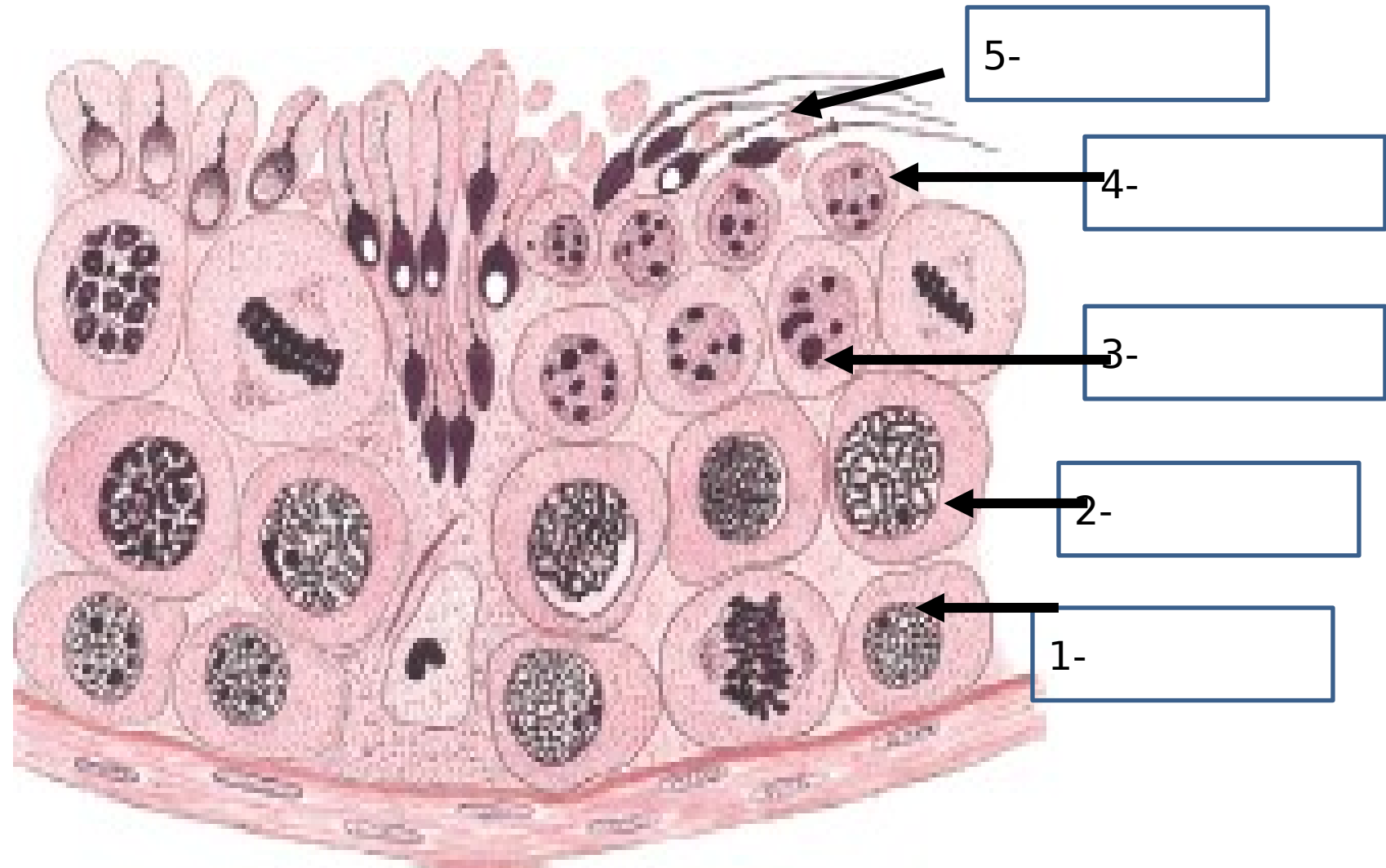


Meiosis II

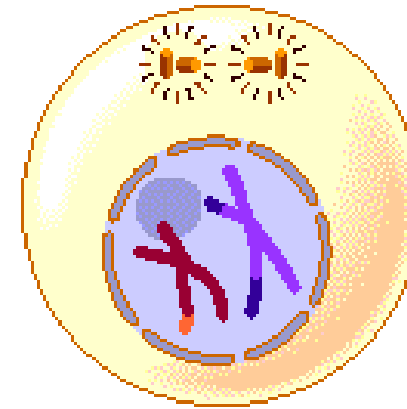
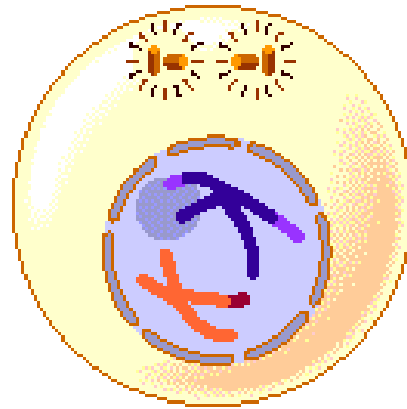
2N



Label the cells with mentioning their chromosomal number



Quiz



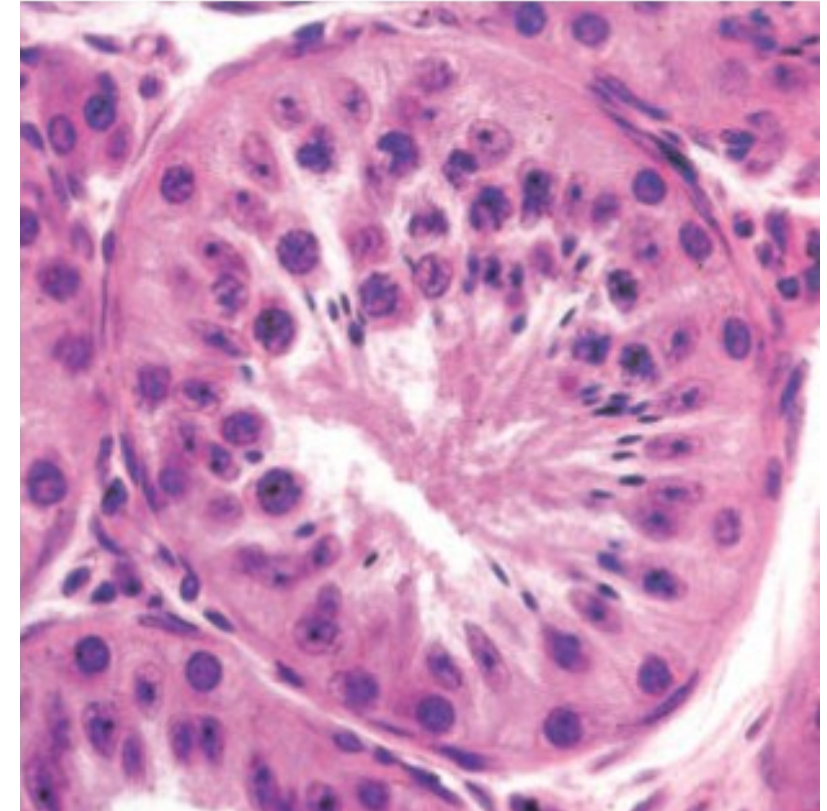
Which division?

Interstitial tissue of the testis



The spaces between the seminiferous tubules within a lobule contain sparse C.T. containing:

- **fenestrated capillaries**, lymphatics, nerves, fibroblasts, mast cells, macrophages,
- **Interstitial cells of Leydig.**



Interstitial cells of Leydig



Site: between seminiferous tubules

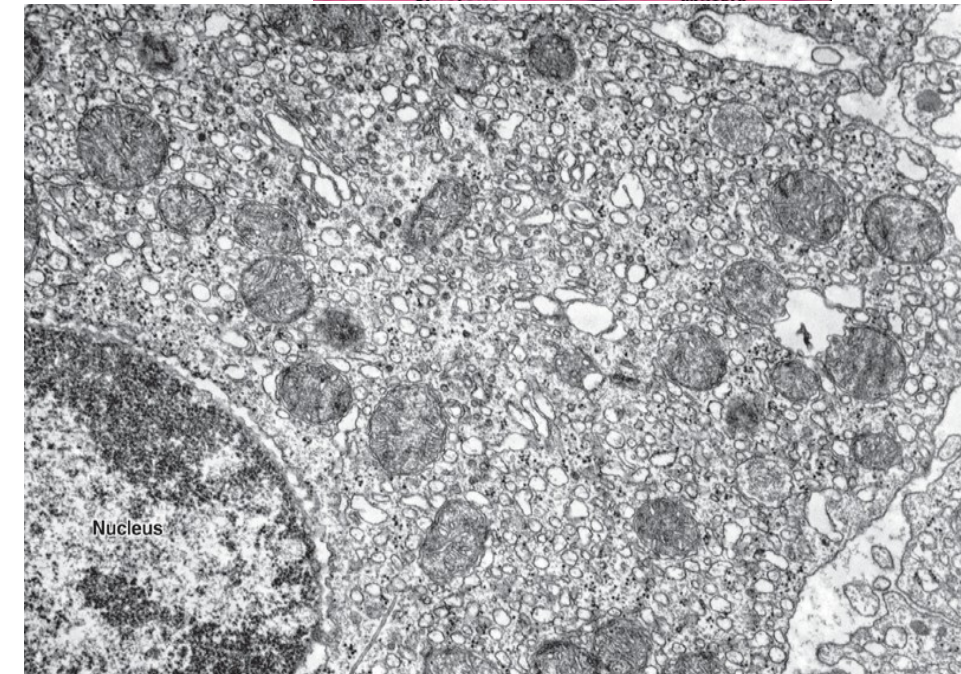
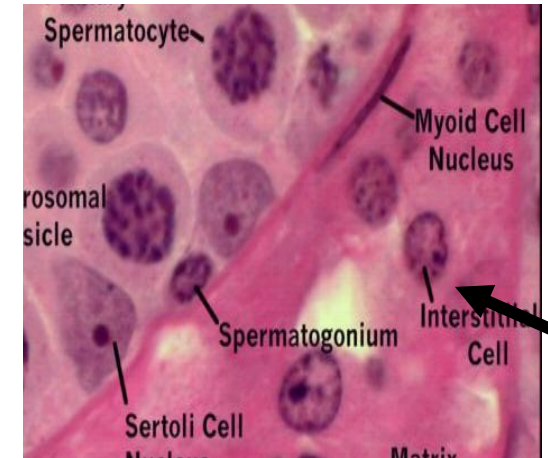
LM:

- shape: rounded polyhydral, present singly or in groups
- pale acidophilic vacuolated** cytoplasm rich in **lipid** droplets.
- single central rounded **vesicular** nucleus

EM:

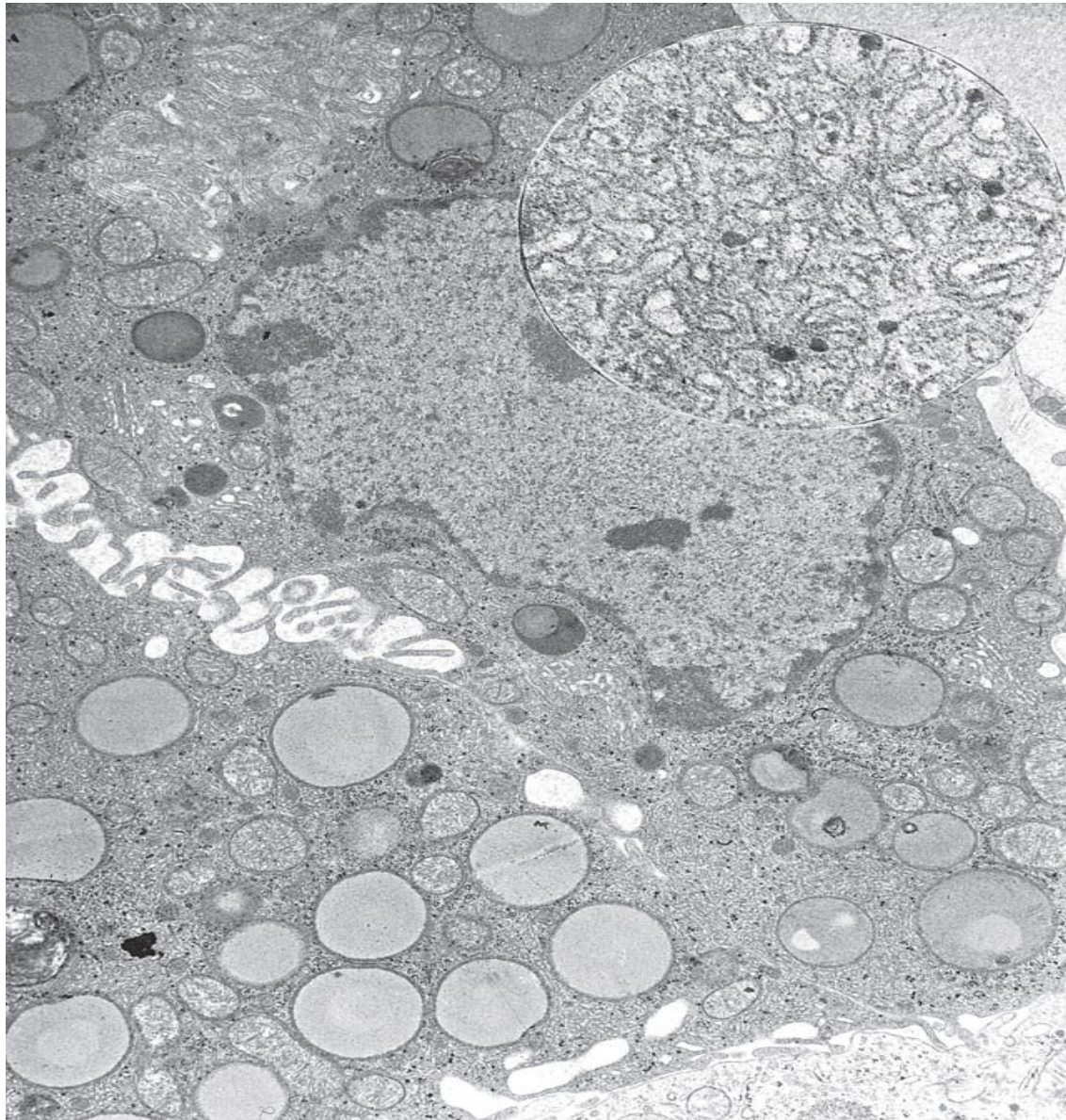
- abundant **smooth ER**
- mitochondria** with tubular cristae
- **Golgi** apparatus
- numerous **lipid** droplets
- Lysosomes, peroxisomes, some rER
- lipofuscin pigments especially in older men

(characters of steroid producing cells).



No secretory granules because the cells secrete without storage of their production

Interstitial cells of Leydig



NB

-Crystals of Reinke are inclusions formed of crystalloid protein and they are a characteristic of the interstitial cells of Leydig.

Functions:

secretion of **testosterone** under control of LH from Gonadotrophs.

Testosterone is important for spermatogenesis, male sex characters.

Male reproductive system



1- **Testis** (sperms & testosterone)

2- **Duct System**

1- Straight tubules

2- Rete testis

3- Efferent ductules

4- Epididymis

5- Vas deferens

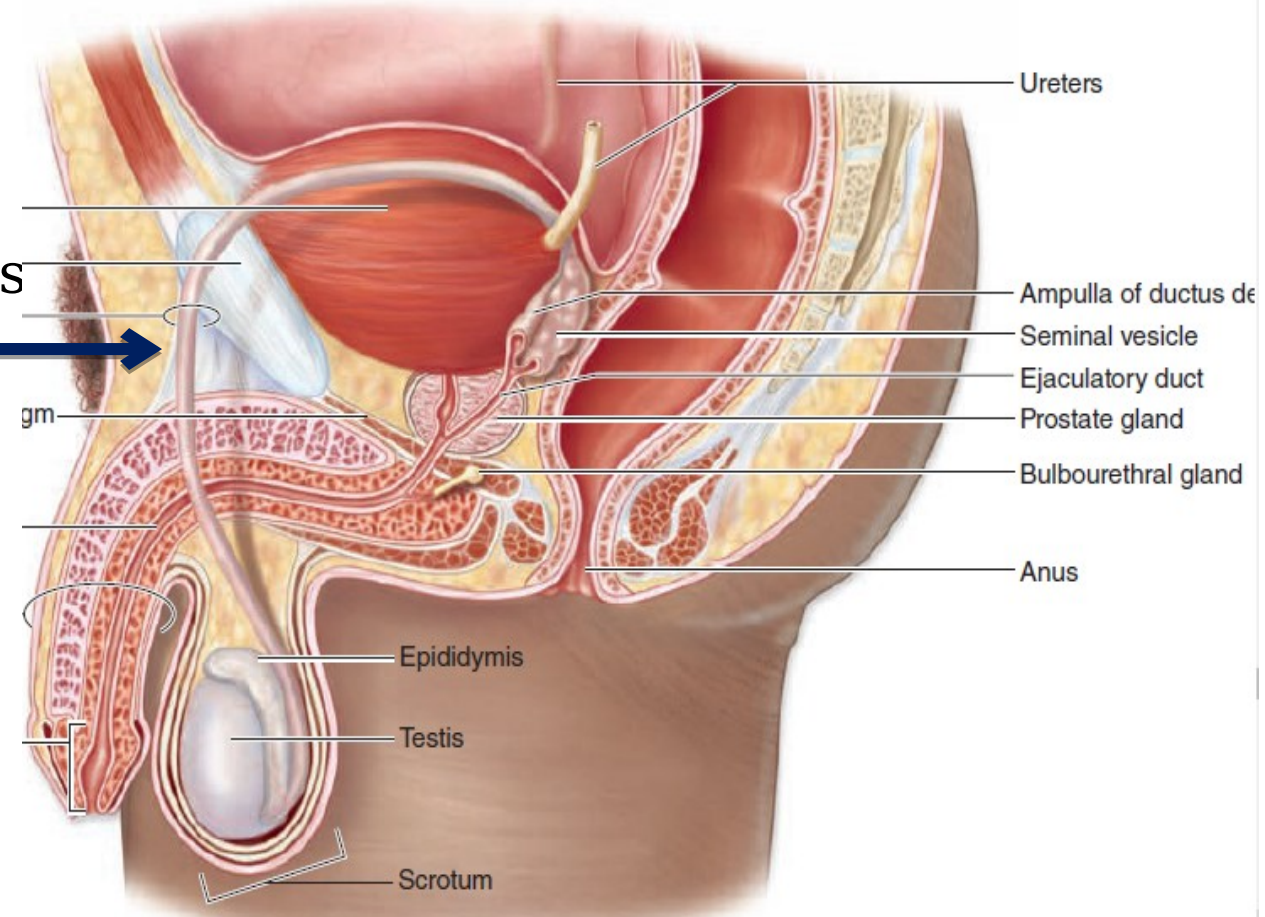
3- **Accessory organs**

1- Prostate

2- Seminal vesicles

3- Bulbourethral gland

4- **Penis**



Ducts of the male reproductive system



VD

ED

E

1- **Straight tubules** (tubuli recti)



2- **Rete testes**



3- **Efferent ductules** (ductuli efferentes)



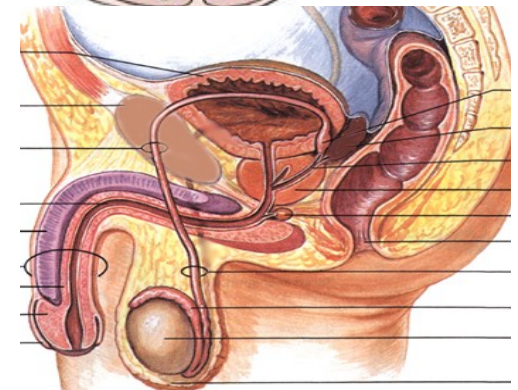
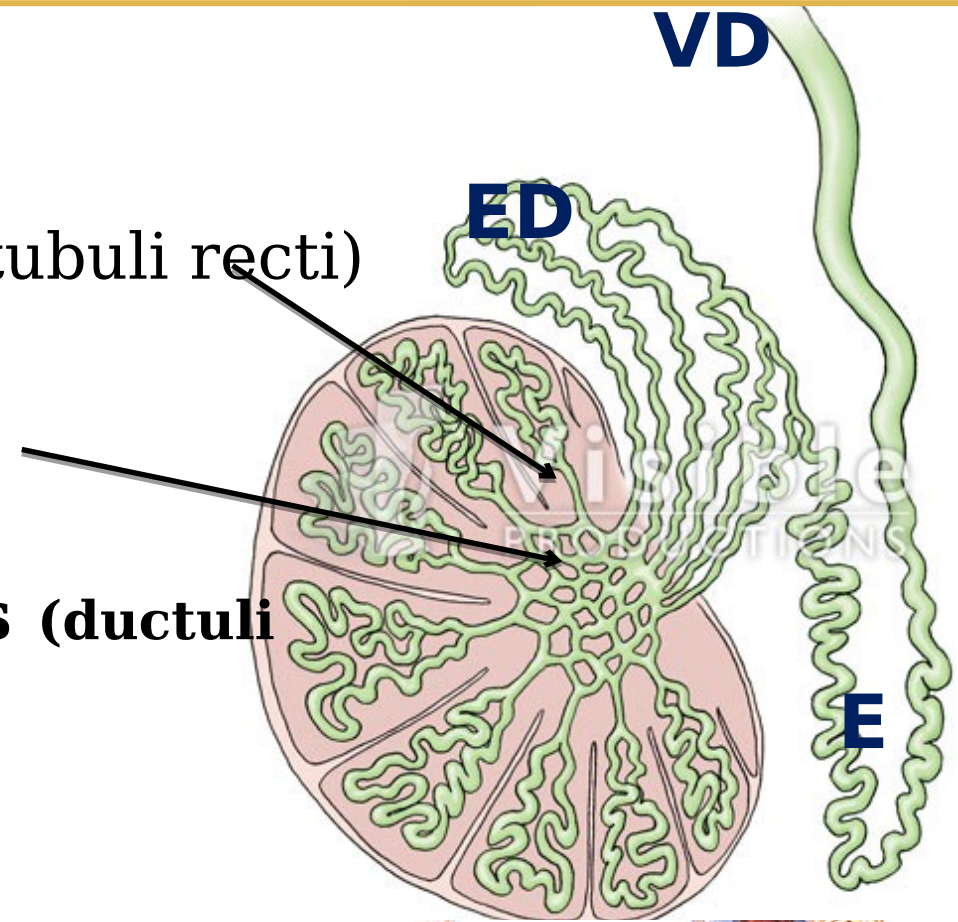
4- **Epididymis**



5- **Vas (ductus) deferens**

Intratesticular

Extratesticular



Ducts of the male reproductive system



Straight tubules (tubuli recti)

Lined with **Sertoli cells**

2- Rete testis

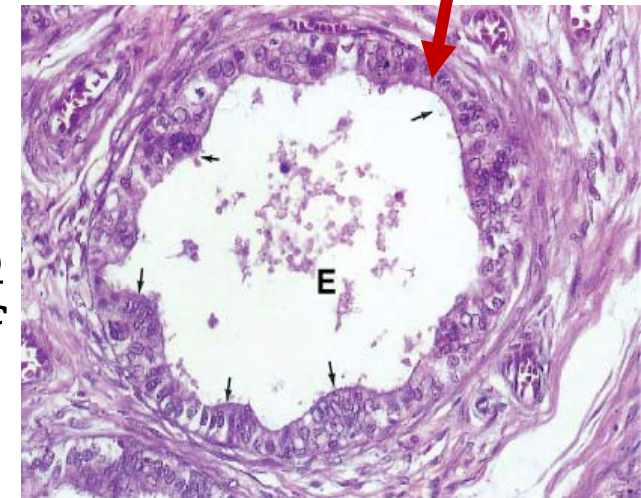
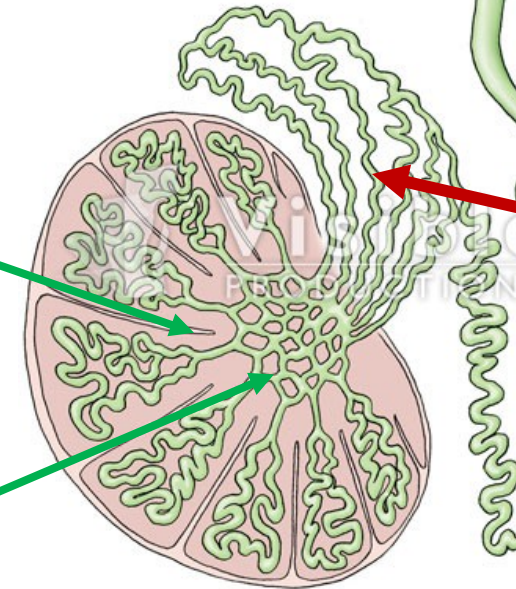
interconnected network of channels lined by **simple cuboidal cells** .

3- Efferent ductules (ductuli efferentes)

about 20

Lined with groups of **non-ciliated** cuboidal cells (**absorb** most of fluid secreted by Sertoli cells) alternate with groups of **taller ciliated** columnar cells (motile cilia)

A thin layer of **circular smooth muscles** (aid sperm movement to epididymis)



Ducts of the male reproductive system; epididymis



4- Epididymis

a- **Head:** entrance of efferent ductules.

b- **Body:** highly coiled single tube

LM: **Tail**

Duct of epididymis has a **wide lumen** and **thin wall**

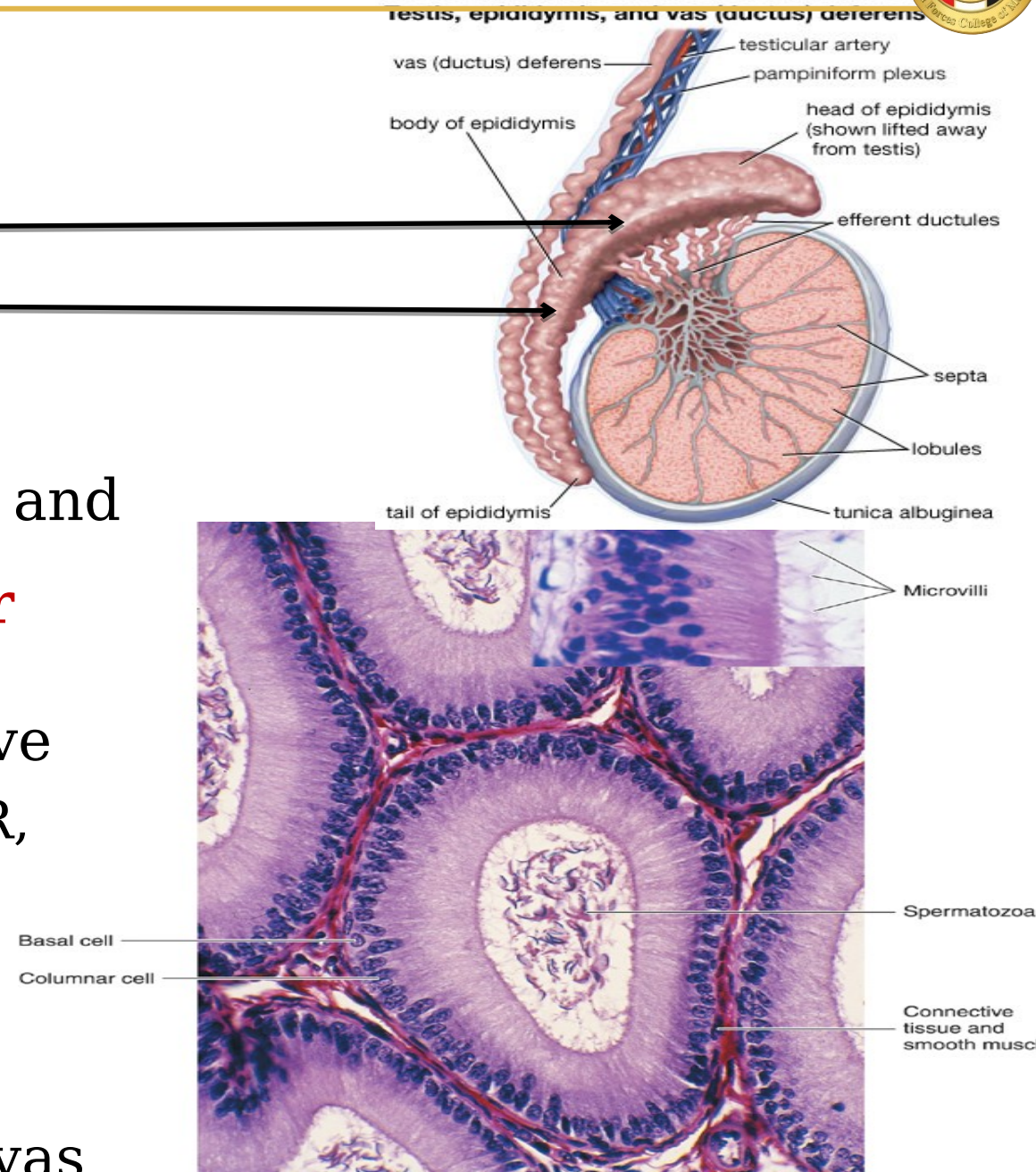
Lining ep.: **Pseudostratified columnar** epithelium

-**Principal cells:** tall columnar cells have **non-motile stereocilia**. EM shows RER, lysosomes, prominent Golgi complex.

-Basal cells act as stem cells

Lamina propria

circularly arranged smooth muscle fibers that helps to push the sperms to vas



Ducts of the male reproductive system; epididymis



Functions of epididymis:

- 1- **Absorption** of **water**, excess fluid (about 90% of the testicular fluid).
- 2- remove residual bodies
- 3- **Secretion of proteins, glycoproteins, exosomes**
(role in **maturation and motility** of the spermatozoa)
- 5- Decapacitation factors to block acrosomal reaction

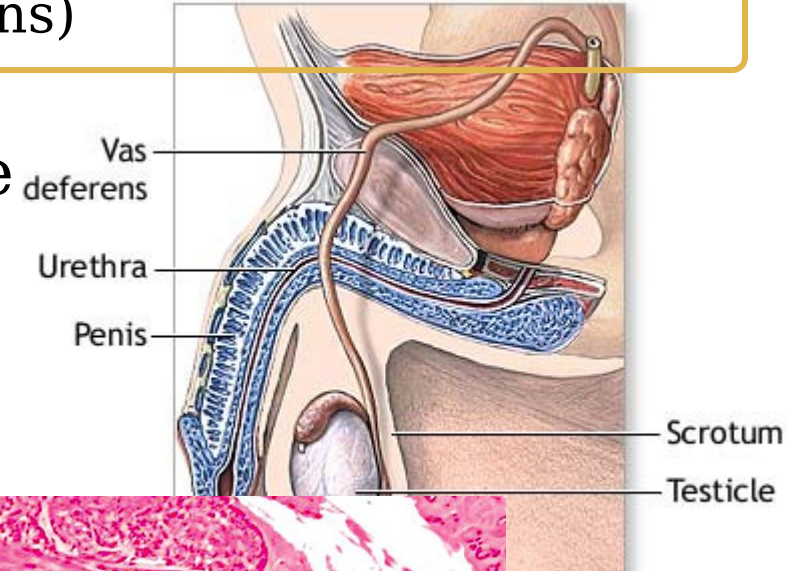
Changes in spermatozoa while passing through the epididymis include:

1. Development of competence for forward motility,
2. Reorganization of the cell membrane surrounding sperm head, by addition “decapacitation factors”, which block the acrosomal reaction, a key event in fertilization.

5- **Vas deferens** (ductus deferens)

Site: It extends from the tail of epididymis to the prostatic part of urethra.

Shape: a narrow irregular lumen,
a **thick muscular wall**

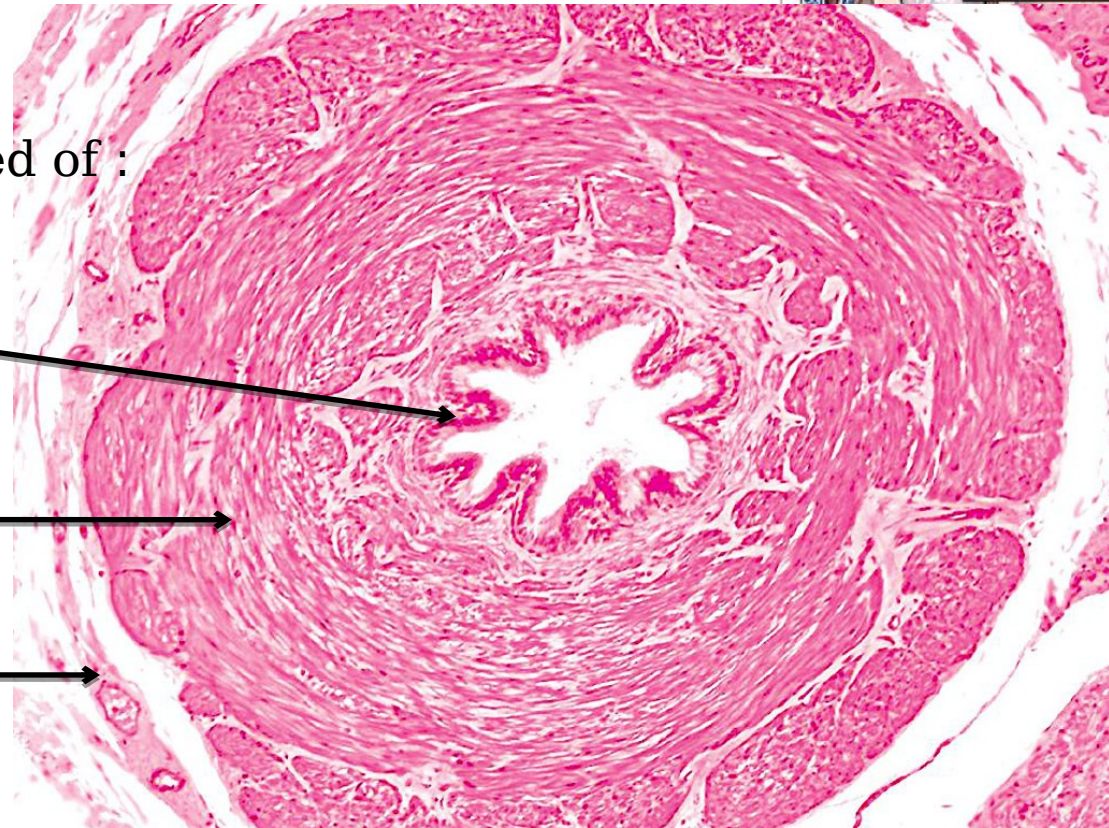


Wall of vas deferens is formed of :

1- Mucosa

2- Muscle layer

3- Adventitia



5- **Vas deferens** (ductus deferens)



1- **Mucous membrane:**

-Lining ep.: **pseudostratified** columnar ep. with **sparse stereocilia**.

-Lamina propria: loose C.T. with collagen fibers, **many elastic fibers**.

2- **Muscle layer:**

Thick, consists of **3 layers** of **smooth** muscle fibers:

-**inner** thin **longitudinal** layer

- **middle thick circular** layer

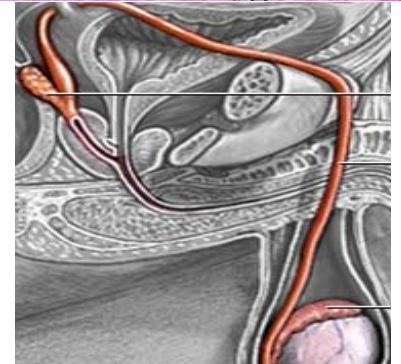
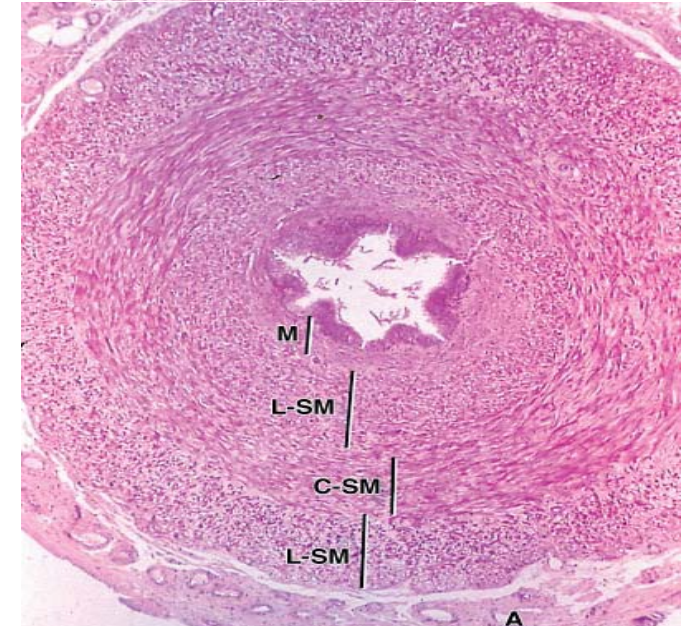
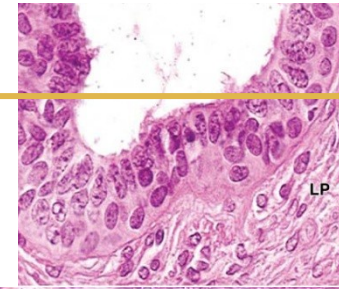
-**outer** thin **longitudinal** layer

3- **Adventitia:** loose fibro-elastic C.T. containing blood vessels, nerves

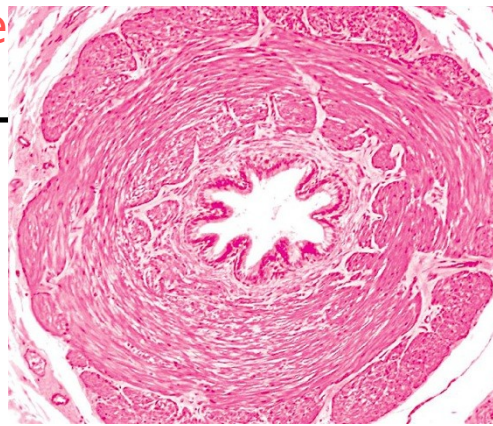
The terminal part of vas deferens is dilated forming **Ampulla** (**thicker ep, more folds**)

Function:

pushes sperms to urethra during ejaculation by **contraction of the muscle** in its wall.



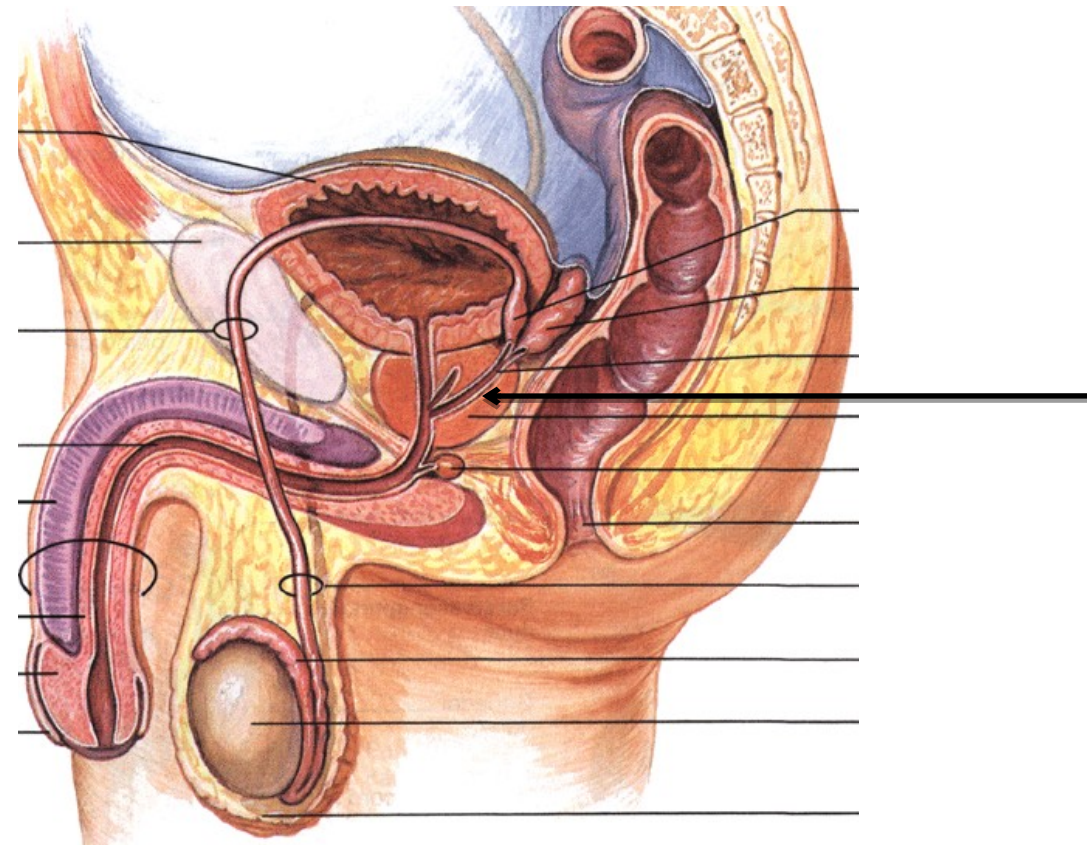
| | Vas Deferens | Ureter |
|-----------|--|---|
| Length | 45 cm | longer |
| Diameter | 3 mm | wider |
| Lumen | Very narrow, folded | Wider, more folded |
| Mucosa | <ul style="list-style-type: none"> ➤ <u>Pseudo-stratified columnar</u> with stereocilia ➤ Narrow layer of loose C.T. contain b.v., nerves, lymphatics, elastic fibers | <ul style="list-style-type: none"> ➤ <u>Transitional</u> epithelium ➤ Wide layer of loose C.T. contain b.v., nerves, lymphatic |
| Musculosa | Thicker, well developed Both contain <u>inner long., thick middle circular & outer long. layers of sm. m.</u> (upper 2/3 of ureter, inner circular & outer long.) | Thinner, less developed |
| covering | By serosa | Peritoneum |



6- Ejaculatory duct



- formed of union of the vas deferens with the duct of the seminal vesicle.
- joins the prostatic urethra inside the prostate.
- lined by simple columnar epithelium and pseudostratified ep (no muscle).



Spermatic cord



formed of:

- Vas deferens**

- Testicular artery** and vein which is surrounded by

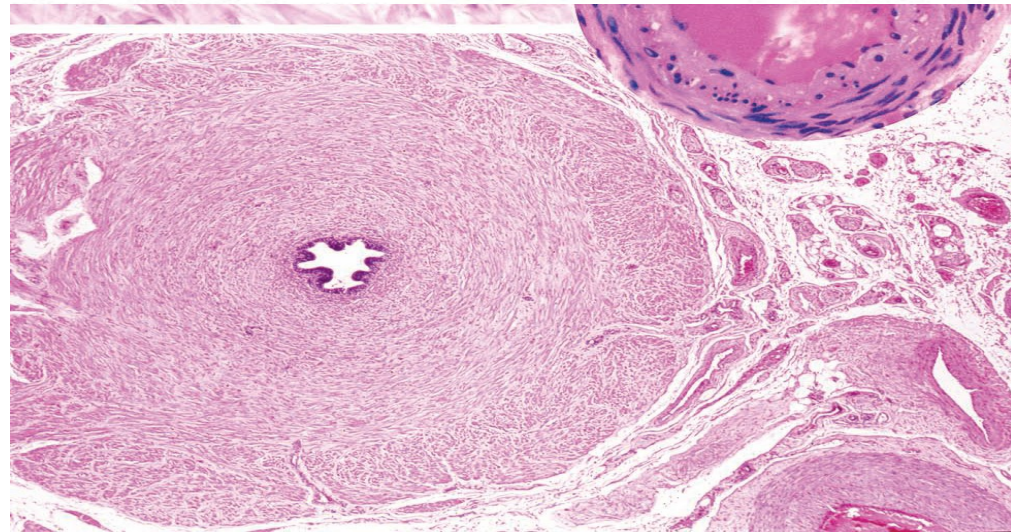
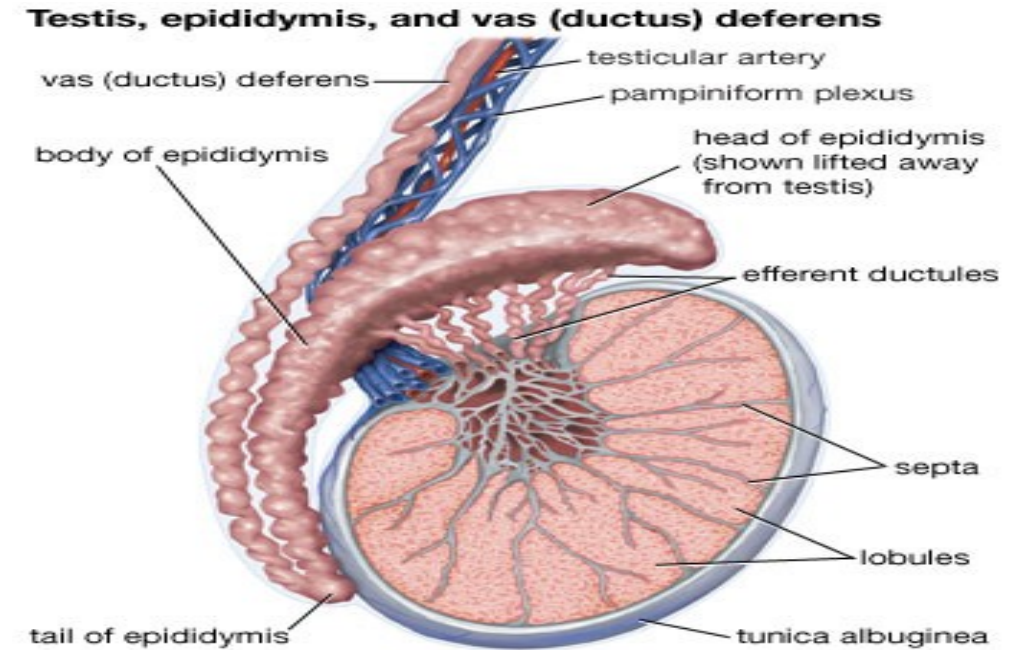
- Pampiniform plexus of veins**

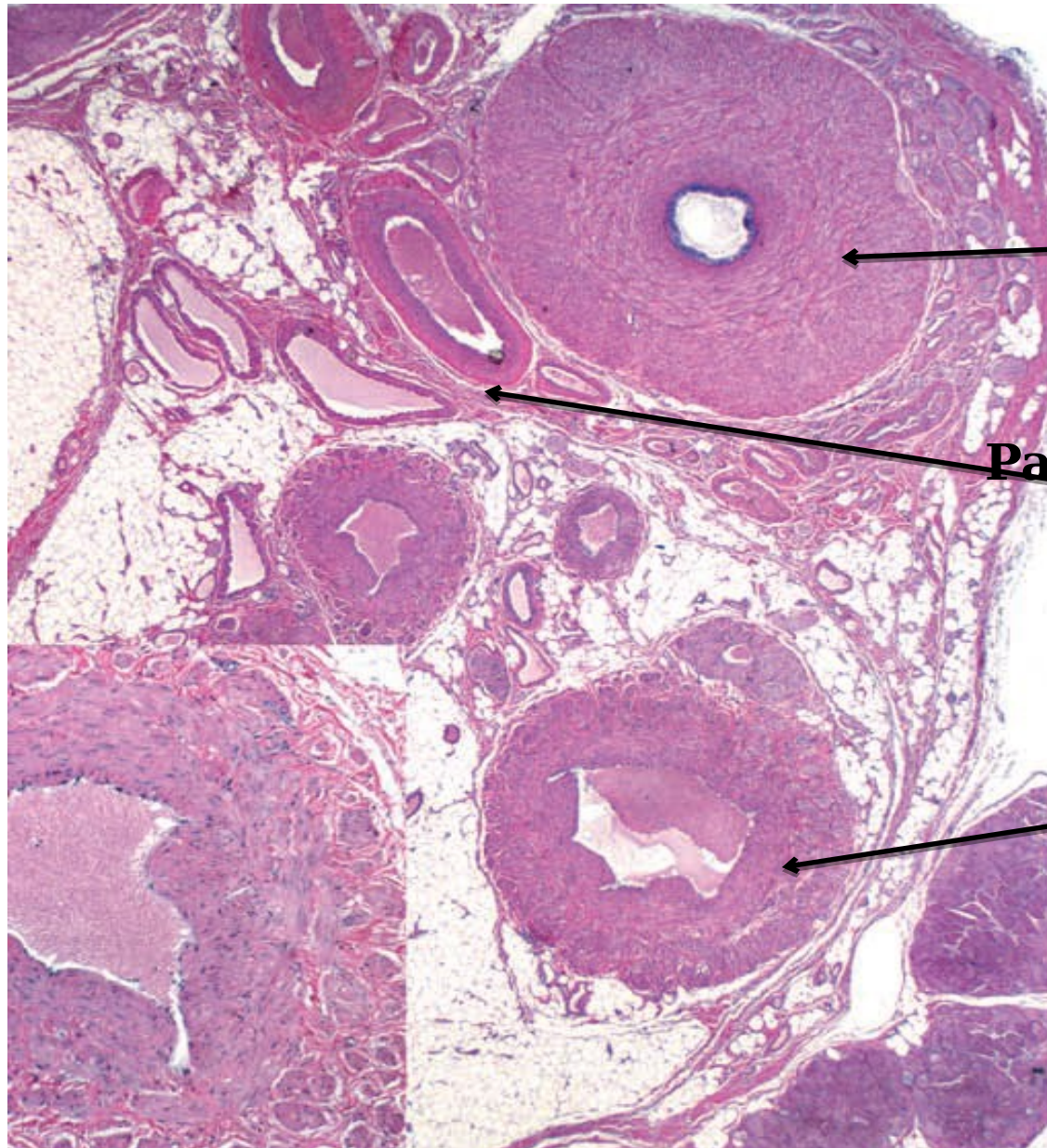
(allows **heat exchange** between the blood vessels and helps maintain the testes at a lower temperature)

- nerves

- lymphatics

- cremasteric muscle** which is striated voluntary muscle.



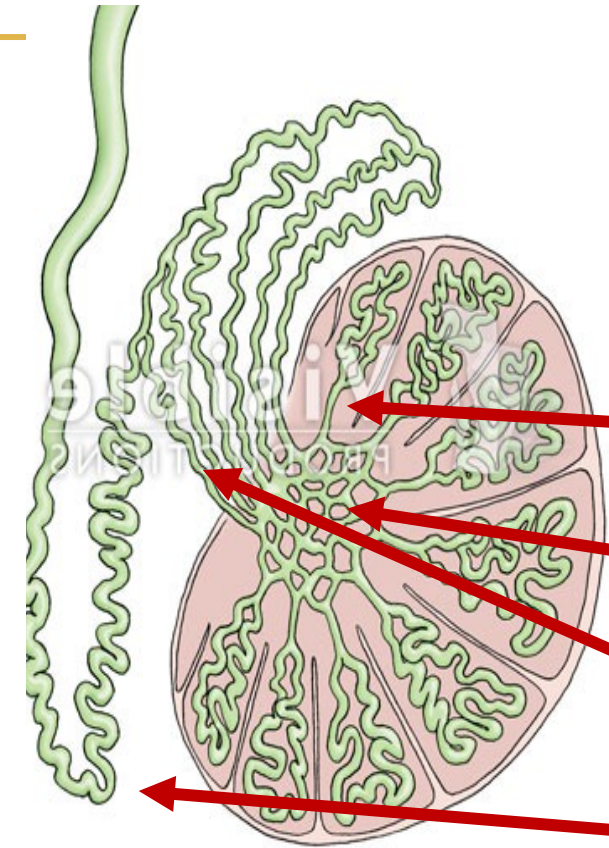


Vas deferens

Pampiniform plexus of veins

Testicular artery

Compare between the different parts of male genital duct system



| | Epithelium | Surroundin g muscle | Function |
|-------------------|------------|------------------------|----------|
| Tubuli recti | | | |
| Rete testis | | | |
| Efferent ductules | | | |
| Epididymis | | | |
| Vas deferens | | | |
| Ejaculatory duct | | | |
| | | | |

Lecture Quiz



Reduce the effect of epididymitis on male fertility

Acute **epididymitis** is a result of **sexually transmitted infections** such as gonorrhea -----intrascrotal pain and tenderness. Persistent inflammation of the epididymis, such as that associated with **gonorrhea** infections, includes massive invasion by leukocytes, stimulating fibrosis that obstructs the epididymis and is a common cause of **male infertility**.

SUGGESTED TEXTBOOKS



- 1. Junqueira`s Basic Histology; Text and Atlas. 15th edition 2018.**
- 2. Histology A Text and Atlas: Michael H. Ross and Wojciech Pawlina, 7th edition, 2016.**



Thank
you



